

Genus AUTOCHARIS, Warren, MS.

18. *Autocharis amethystina*, sp. n.

♂. Palpi pinkish brown; antennæ, body, and wings luteous white; thorax with a pinkish-brown stripe on each side. Fore wings with the costal border pinkish brown; a broad pinkish-brown marginal band: hind wings with a narrow similar band; the inner edge of both bands dark brown, sinuous, with a dentation into the band on the fore wings in its centre; cilia of both wings pinkish white. Underside: legs, body, and wings white; the wings are semi-hyaline, and the marginal band shows through the wing.

Expense of wings $\frac{6}{10}$ — $\frac{7}{10}$ inch.

Cherra Punji; one example. North Kanara; two examples.

Allied to *A. fessalis*, Swinhoe, which Warren makes the type of the genus.

XXIII.—*Vestigial Stigmata in the Arachnida.* By H. M. BERNARD, M.A. Cantab. (Huxley Laboratory, Royal College of Science, South Kensington).

IN a preliminary note published in this Journal *, and later in a fuller paper published by the Linnean Society †, I called attention to a row of scar-like markings in certain Chernetidæ which segmentally repeat the functional stigmata. These markings are, so far as one can see with the best microscopic appliances, nothing but scars. Hansen ‡, who has also seen them, believes them to be lyriform organs. At first, after reading Hansen's paper, it seemed to me that they might well be very large lyriform organs (as to the functions and morphology of which we really know nothing §) and at the same time the remains of vanished tracheal invaginations. I have since compared the scars with lyriform organs in the Chernetidæ, Araneidæ, Solpugidæ, Thelyphonidæ, and Phrynidæ, and am convinced that they are not lyriform organs at all, but simply the scars of apertures which have now closed. I have mapped out the abdominal surface of my original specimen (figured in the second paper above referred to), measuring, by means of an eyepiece micrometer, the relative positions of the scars and the bristles, which, as is well known, tend in this group to be repeated segmentally. I am quite satisfied

* "Additional Notes on the Origin of the Tracheæ from Setiparous Glands," Ann. & Mag. Nat. Hist. 1893, xi. p. 24.

† "Notes on the Chernetidæ, with Special Reference to the Vestigial Stigmata and to a new Form of Trachea," Journ. Linn. Soc., Zool. vol. xxiv. p. 410.

‡ 'Organs and Characters in different Orders of Arachnids,' Copenhagen, 1893.

§ These organs are so minute and so scattered that it seems to me that no trustworthy experiments are possible (cf. Gaubert's "Recherches sur les Arachnides," Ann. Sci. Nat. xiii. 1892).

that these particular scars are the segmental repetitions of the stigmatic apertures, whether they are now anything more than scars or not. Hansen, however, points out that similar scars may be found on the anterior abdominal segments nearer the middle line concurrently with those that repeat the stigmata. This interesting fact, which I have since fully confirmed for two segments (II and III) in my original specimen, in no way affects the above conclusions. There must at one time therefore have been apertures here also which have now closed. It is hardly likely that they were tracheal invaginations, although there is no impossibility in there being two pairs to one segment—that is, if tracheal invaginations can be deduced from primitive setiparous glands. It is more probable that they were the openings of spinning- or cement-glands. Such glands exist in these very segments in many Chernetidæ; and in the Araneidæ, in addition to the large spinning-mammillæ, smaller ones may occur in the same segments nearer the median line. We are, however, here chiefly concerned with the fact that a row of scars segmentally repeats the functional stigmata along the whole length of the abdomen.

The bearing of this on the origin of the Arachnida I have already discussed in 'Nature'*. It points to the deduction of the Arachnida from an ancestral form with a pair of limbs and a pair of stigmata on *every* segment.

Further evidence of this has been slowly accumulating. Reserving for the present that which is specially connected with the Galcodidæ, one important item deserves to be separately discussed. If any collection of Thelyphonidæ be looked through carefully † it is impossible to avoid the conclusion that these Arachnids once possessed limbs with stigmata along at least seven abdominal segments. The specimens require to be dried and then held so that the abdomen reflects the light from the window. Very few indeed showed no traces at all. The large majority show on segments V, VI, VII, VIII, just laterally to the muscle-impressions, definite scar-like markings, or even sharply circumscribed areas, such as I have shown in figs. 1 and 2.

The posterior margin of this area is, as a rule, seen most distinctly. In some, however, the strongest mark is the inner posterior corner of the area; in others, again, the inner longitudinal side, which, however, then generally slopes outward posteriorly (*e. g.* many individuals of *Thelyphonus*

* "The Stigmata of the Arachnida as a Clue to their Ancestry," 'Nature,' Nov. 16, 1893.

† My best thanks are due to my friend Mr. R. I. Pocock for permitting me to examine many scores of specimens (both alcohol and dry) under his charge in the South Kensington Museum. I was enabled to examine specimens of five genera—*Thelyphonus*, *Thelyphonellus*, *Uroproctus*, *Mastigoproctus*, and *Typopeltis*.

sepiaris). There is great difference in the degree of distinctness even among specimens of one and the same species. The two figured were chosen at random; others even more distinct could doubtless be found.

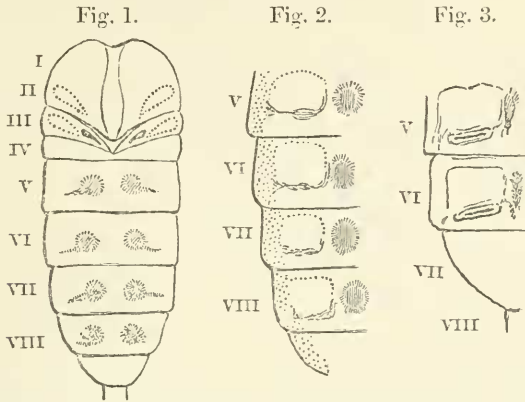


Fig. 1.—Abdomen of *Thelyphonus manillanus*, C. Koch, showing the stigmatic scars; the functional lung-books are marked by dotted lines.

Fig. 2.—*Typopeltis Stimpsonii*, Wood, showing the stigmatic scars along the posterior edges of definite areas.

Fig. 3.—*Prionurus australis*, Linn., showing the stigmata along the posterior edges of sharply defined areas.

While the anterior and outer (lateral) edges of the areas seem marked off more by change in the character of the surface of the chitin, the inner and posterior edges, especially the latter, are scar-like — often very pronounced scars indeed. It will be seen from fig. 1 that these areas repeat segmentally the positions (and the scars the apertures) of the lung-books in the second and third segments. Any doubt as to this seems to me to be set at rest by a comparison with *Scorpio*, in which we have almost exactly similar areas with stigmatic apertures along their posterior margins. Fig. 3 was drawn from the scorpion which happened accidentally to be nearest me on the table. Any scorpion will show similar areas more or less distinctly.

No one, I believe, doubts the homologies of the lung-books of *Scorpio* and *Thelyphonus*. The areas with these scars on segments V and VI of *Thelyphonus* must correspond with the areas with their stigmata on segments V and VI of *Scorpio*. If this reasoning is correct, *Thelyphonus* originally possessed at least seven pairs of lung-books, five pairs of which have now vanished.

Counting the genital opercula, we have therefore in *Thelyphonus* vestiges of eight pairs of abdominal limbs on the first eight segments.

This comparison of *Scorpio* with *Thelyphonus* makes it also evident that the tails in both these animals are not primitive structures. The tail is a later specialization, in *Scorpio* of five segments, in *Thelyphonus* of three. This follows from the fact that segments which in *Scorpio* form the tail, in *Thelyphonus* are typical abdominal segments, unspecialized in any way.

Further, if it is possible to homologize the anal glands of *Thelyphonus*, which open on each side of the soft circumanal membrane and which are said to secrete formic acid, with the poison-glands of *Scorpio*, and both these with the original invaginations of the scar found on each side of the anal papillæ in the Chernetidæ, it follows that all these tail-segments once possessed limbs with tracheal invaginations or their homologues. We now know, indeed, from *Thelyphonus* that the first tail-segment of *Scorpio* (the eighth) did actually at one time possess a pair of limbs (*cf.* figs. 2 and 3).

As I have shown in my paper on the Galeodidæ (still in manuscript), there is some evidence to justify us in believing that the areas under discussion in *Scorpio* and *Thelyphonus* represent limbs which have vanished. The primitive position of the stigmatic aperture was probably just behind the coxa, perhaps even on its posterior face. This is the position of the thoracic stigmata of *Galeodes* with reference to the fourth pair of limbs. If such a limb with a stigmatic aperture behind it were to become rudimentary, it might either fold backwards over the stigma, forming a kind of stigmatic operculum, or it might simply flatten down, leaving the stigma free on the sternal surface. Examples of both these processes may be found in the Arachnida, not only within the same group, but even in the same animal. For instance, in *Thelyphonus* the functional stigmata open under opercula in the squeezed-up anterior segments, whereas in the long segments their scars are found along the posterior edges of the areas, which I take to represent rudimentary limbs flattened down on the sternal surface. In *Scorpio* the rudimentary limbs have been simply flattened down, leaving the stigmata upon them. In the Galeodidæ in some genera the stigmata are under opercular folds, in others the folds have flattened down, leaving the stigmata exposed on the abdominal surface.

In reference to the origin of these areas in the Arachnida from rudimentary limbs which have disappeared by simply becoming flattened down, it is interesting to note that the stigmatic apertures in *Scorpio* very generally slope backwards. In some the slope is very pronounced and is often parallel with that of the pectines. It looks as if all these abdominal limbs in *Scorpio* had once sloped backwards, as the posterior functional limbs and the pectines still do. In some genera,

again, the pectines slope much more than the stigmata, the genital aperture having been secondarily (and since the disappearance of the abdominal limbs) further pushed forward, almost totally obliterating a sternal area usually found in front of the genital opercula in those genera in which the pectines have only a moderate slope.

I refer again to my paper in 'Nature,' above cited, for some of the bearings of these vestigial stigmata on the primitive morphology of the Arachnida.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

March 7, 1894.—Dr. Henry Woodward, F.R.S.,
President, in the Chair.

The following communications were read:—

1. 'The Systematic Position of the Trilobites.' By H. M. Bernard, Esq., M.A., F.L.S., F.Z.S.

The Author, in his work on 'The Apodidæ,' endeavoured to show that *Apus* was the ancestral form of all existing crustacea except the Ostracoda, and as such might be expected to throw light upon the trilobites. Since the publication of this work he has been studying the organization of the trilobites themselves, and the results are given in the present communication. He discusses the great variability in the number of segments shown by the trilobites; the formation of the head by the gradual incorporation of trunk-segments; the bending round ventrally of the first segment; the 'wandering' of the eyes; the existence and modification of the 'dorsal organ'; and especially the character of the limbs.

As a result of this discussion, he states that the zoological position of the trilobites can now be fixed with considerable probability. The features described serve to connect the trilobites with *Apus*. *Apus* must be assumed to lie low in the direct line up from the original annelidan ancestor towards the modern crustacea, and the trilobites must have branched off laterally from this line, either once or more than once, in times anterior to the primitive *Apus*, as forms specialized for creeping under the protection of a hard imbricated carapace, obtained by the repetition on every segment of the pleuræ of the head-segments, which together form the head-shield.

The trilobites may be briefly described as fixed specialized stages in the evolution of the crustacea from an annelidan ancestor with its mouth bent round ventrally, so as to use its parapodia as jaws.

2. 'On the Discovery of Molluscs in the Upper Keuper at Shrewley, in Warwickshire.' By the Rev. P. B. Brodie, M.A., F.G.S.

Mr. R. B. Newton read a paper at the meeting of the British Association at Nottingham in 1893, on some lamellibranchs found at Shrewley by the Author of the present paper and Mr. Richards. In this paper details of the section where the shells were found are given, and their interest and importance pointed out, no shells having been previously detected anywhere in the New Red Sandstone in this country.